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PEST MANAGEMENT

In this issue:

Plus:

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ICT Update is a bimonthly bulletin focusing on information and communication technologies and their applications for agricultural and rural development in ACP countries

Editorial

New approaches to pest control

Insect pests reduce global food output by 25% to 35%, in spite of pesticide applications costing some US$ 32 billion annually.[1] New ways to combat the major pests are urgently needed in order to ensure food security for the world's growing population.

This issue of *ICT Update* illustrates that ICTs are playing an increasingly important role in integrated pest management (IPM), particularly in the areas of pest identification, prevention, education, knowledge sharing and eradication.

In the field of pest identification, numerous online databases and innovative software applications are available to define and recognize pests (see TechTip).

In the area of pest prevention, geographical information systems (GIS) are now widely used to identify the areas at risk of pest invasions, and thus where preventive measures are needed. Rose W. Irungu *et al.* report on Awhere-ACT, a user-friendly tool that is helping farmers in Africa to combat pests such as stem borers and the cassava green mite.

Equally important ICT-based initiatives are being implemented in pest education. CABI's Crop Protection Compendium, for example, is an interactive database on plant protection that is available online and on CD-ROM. Amadou Bocar Bal and Julia Brunt describe how it is used as a training tool in Tanzania and Niger.

In the area of knowledge sharing, Grahame Jackson *et al.* show that innovative IPM initiatives do not have to be high-tech and costly. Their PestNet project is an Asian-Pacific pest management email network that is both easy to maintain and highly effective.

There are also promising ICT developments in the field of pest eradication. Shantanu Mathur explains how an IFAD project aimed at eradicating the Carambola fruit fly in Suriname and French Guiana is using satellite technology to effectively target infested areas.

Finally, Dr Yunlong Xia, Head of ICIPE's Information Technology and Bioinformatics Department in Kenya, reviews the status of and trends in combining IPM and ICTs in developing countries, and offers a promising glimpse of the road ahead.

[1]*http://ictupdate.cta.int/index.php/link/a/157/*

ICT Update

ICT Update is a bimonthly printed bulletin, a web magazine *(http://ictupdate.cta.int)*, and an accompanying email newsletter. Each issue focuses on a specific theme relevant to ICTs for agricultural and rural development in African, Caribbean and Pacific (ACP) countries, and features four commissioned articles. The printed bulletin also contains a selection of relevant links and projects and a 'Question and Answer' section, taken from the website. Readers are invited to contribute to the site by adding links to online resources on a particular theme. Simply log on to the *ICT Update* website, and click on one of the 'submit' options in the right-hand column.

The next issue of *ICT Update* will be available on 1 July 2003.

TechTip

Lucid: a tool for identifying pests

To identify an insect, an entomologist will first narrow down the range of possibilities by examining the creature's appearance. For instance, if it has two wings it will most probably be a species of fly. If it has eight legs, chances are it will be a spider. This process of identification has become a lot simpler and faster with the advent of database and multimedia software. It is now possible to store large amounts of biological data and to access this information through user-friendly, matrix-based directories, or 'keys'. One such multimedia matrix key is Lucid, a comprehensive and powerful tool developed at the Centre for Biological Information Technology (CBIT), University of Queensland, Brisbane, Australia, that is available via the web or on CD-ROM. Anyone, whether a biology professor or a farmer, can use Lucid to identify any insect pest and retrieve the necessary information on how to combat it.

Example scenario

Imagine you find a fly in your field, and you want to make sure it's harmless. To identify it and find out more about it, you simply start up Lucid and select the key on flies. The key will present you with a series of features from which you select those that are true for your particular fly, consequently reducing the list of the species it is likely to be. For instance, you can select the colour of the fly's body, its size, the geographical location of your field, and so on. As you proceed through the identification, various multimedia modules (images, video, sound) and processing functions will help you reduce the list. Once you have identified the fly species, Lucid offers descriptive notes, illustrations, sound recordings and videos. It also provides links to websites and experts offering more detailed information and advice on what pest management steps you may need to take.

Relevant links

To learn more about Lucid, visit *www.lucidcentral.com/about/aboutlucid.htm*. The standard application can be downloaded free from *www.lucidcentral.com/downloads/download.aspx*.

PestNet: An Asian-Pacific pest management email network

Grahame Jackson *et al.*

Pests severely limit agricultural production in tropical countries, and when they attack, the damage can be devastating. Farmers need advice immediately; they cannot wait. But to get the correct information on the best control measures takes time. If insects have to be reared or samples prepared for identification, it is time-consuming. If there is no local taxonomist, and specimens have to be sent overseas, the process takes even longer, and can be costly. To make matters worse, many countries do not have reference collections of insects, diseases and weeds, or adequate libraries to check pest control recommendations. Even if the information is available – in books, journals, CD-ROMs or even online – it is sometimes difficult to interpret or it may not cover all the pests of concern.

PestNet is an informal network, using email to link people offering advisory pest management services in developing countries.

PestNet was created in 1999 to help overcome these constraints in the Asia-Pacific region. It is an informal network, using email to link people offering advisory services in developing countries with specialists worldwide. Although originally set up as a service for the Pacific, the network has since expanded to help farmers in Asia. Registered as a non-governmental organization (NGO) in Fiji, PestNet is a free service run entirely by volunteers.

The network deals with topics ranging from quarantine concerns, biological control and pest management issues, pest outbreak alerts, and various forms of the question: 'what's this pest and how can I control it?' It is this last category that has transformed PestNet from a discussion forum into a free online identification service that has proved extremely effective. Digital photographs of pests attached to messages have yielded quick responses with tentative identifications, often accompanied by offers from taxonomists to examine specimens for confirmation of diagnoses free of charge.

PestNet uses the Yahoo! Groups email listserver, which is configured to allow a moderator to screen postings before they are distributed to members. This is crucial in order to maintain high standards, and to restrict the size of messages, especially those with image attachments. Many members do not have fast computers and modems. The 'turnaround time' between the posting of a message and its acceptance by a moderator is a few minutes at most. As an example, quarantine officials in the Republic of Palau recently intercepted and photographed a lizard. The image was sent to PestNet, identified by an institute in Beijing, and confirmed by a specialist in Samoa – all within one hour!

The network's success is based on its sustainability, free Internet services, and the enormous enthusiasm of its volunteers to help farmers in developing countries. At present, PestNet has 400 members, more than one-third of whom live in 40 tropical countries, including those in the Pacific and Southeast Asia. Members also come from Africa, the Caribbean and the Middle East. There is an average of 40 postings per month; these are archived on the Yahoo! Groups website and can be searched.

With support provided by the Australian Agency for International Development (AusAID) and the Department of Agriculture, Fisheries and Forestry Australia (AFFA), PestNet recently launched a website, *www.pestnet.org*, and an awareness-raising campaign to promote the expansion of the network.

What does the future hold for PestNet? One of the aims of the service is to take advantage of modern ICTs to enable grassroots organizations and farmers to access the network. Rural email centres are being set up on various Pacific islands, and these offer exciting new possibilities for linking PestNet more directly with its ultimate beneficiaries. A pilot scheme to test this idea will start soon in the Solomon Islands. Four NGOs will collaborate to provide remote communities the opportunity to access timely information on plant pests, especially those that attack staple food crops.

To subscribe to PestNet, simply send a message to *pestnetsubscribe@yahoogroups.com*, or follow the instructions on the website *www.pestnet.org*.

Grahame Jackson currently serves as chair of PestNet (email: *Grahame@PestNet.org*).
PestNet's other moderators are:
Wilco Liebregts (email: *Wilco@PestNet.org*);
Bob Macfarlane (email: *Bob@PestNet.org*);
Banpot Napompeth (email: *Banpot@PestNet.org*);
Mat Purea (email: *Mat@PestNet.org*).

Relevant links

The **Secretariat of the Pacific Community (SPC) Plant Protection Service** collaborates with countries and territories in the Pacific region to reduce the impact of pests, diseases and weeds in agriculture, forestry and the environment, and offers online technical advice, information and extension and diagnostic services. *www.spc.org.nc/pps/*

Africa IPM Link seeks to foster the development of a network of IPM practitioners in sub-Saharan Africa by facilitating access to the Internet and other electronic communication and information exchange tools. Among other things, it hosts AFRIK-IPM, an electronic forum for IPM networking and information sharing in the region. *www.ag.vt.edu/ail/*

Awhere-ACT, a GIS tool to predict pest outbreaks in Africa

Rose W. Irungu, Dave Hodson and Eric I. Muchugu

Scientists in developing countries are becoming increasingly aware of the value of spatial information for assessing and predicting the distribution of insect pests. In this process, geographical information systems (GIS) can play a key role in the management, visualization and analysis of geographical data in digital format. So far, however, GIS have remained largely in the domain of experts, with access often restricted by factors such as cost, complexity and the availability of data, particularly in developing countries.

To rectify this situation, a team of software developers from Mud Springs Geographers, Inc., in collaboration with the International Maize and Wheat Improvement Centre (CIMMYT), developed the Awhere Almanac Characterization Tool (ACT), a stand-alone package that is well suited to the needs of agricultural researchers and decision makers in developing countries. Awhere-ACT is unique in that it integrates GIS tools with extensive databases (on climate, land use, elevation, etc.) relevant to agriculture. It is also user-friendly – with only a few days' training, users can easily generate maps showing, for example, zones with similar climatic conditions in a particular season. The package is available free to users in developing countries.

Scientists involved with a number of insect pest management programmes in Africa are now benefiting from the facilities provided by Awhere-ACT, as the following examples demonstrate.

Spatial information provided by geographical information systems (GIS) can play a key role in assessing and predicting the distribution of insect pests.

Predicting the spread of stem borers

Maize is one of the most important staple food crops in sub-Saharan Africa, but farm productivity is limited by a variety of insect pests, in particular the stem borer beetle. There are several native species of stem borer in the African maize belt, but the exotic *Chilo partellus* is by far the most devastating. Introduced from Asia in the early 20th century, *Chilo* has spread to all countries in East and Southern Africa, and is still extending its range.

The Biological Control of Cereal Stem Borers project of the Nairobi-based International Centre for Insect Physiology and Ecology (ICIPE) is following a classical biological control approach, whereby natural predators associated with *Chilo* in Asia are being introduced into Africa. Using Awhere-ACT, researchers at ICIPE first determine which climatic factors, such as rainfall and temperature, favour the spread of the borer in Asia. They then identify those areas in Africa where the climate conditions are similar, allowing them to predict those that are likely to be at risk of *Chilo* invasions in Africa, and to recommend where to introduce natural predators.

Identifying fungus release sites to control the cassava green mite

The cassava green mite, *Mononychellus tanajoa*, is a major pest that affects cassava in many parts of Africa. Controlling this mite has been the focus of a long-running biological control programme of the International Institute of Tropical Agriculture (IITA). In Brazil, the mite's country of origin, its spread is effectively restricted by a pathogenic fungus, *Neozygites tanajoae*. IITA has recently introduced the fungus as a control agent in Benin, where it has become established in some areas. Based on this success, researchers at the Kenyan Agricultural Research Institute (KARI) and IITA are now using Awhere-ACT to identify areas in Kenya with agro-meteorological characteristics similar to those in Brazil and Benin where *Neozygites* has been successful, so that they can specify the most effective release sites.

In both of these examples, the application of appropriate GIS tools and databases is helping African scientists to make better decisions regarding where to target their pest control interventions, thereby increasing the efficiency of the research process and contributing to the efforts to ensure food security.

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This article is based on contributions from Awhere-ACT users at CIMMYT and ICIPE. Funding for Awhere-ACT in Africa has been provided by USAID.

Relevant links

The **African Remote Sensing Data Bank** was set up by the **ICIPE Insect Informatics Unit** to capture and archive climatic and environmental data relevant to the activities of ICIPE, its partners and collaborators. The data generated from ground observation or remote sensing sources are applied in modelling and simulation, ecosystem analysis, geostatistics, natural resource management and agricultural planning. *http://informatics.icipe.org/databank/maps.htm*

15 Steps to Learning ArcView is a tutorial on the most widely used GIS software package. It is based on a workshop on IPM and GIS by leading GIS expert Larry Grossman, held in Uganda (2002). Basic steps include identifying and labeling features on a map; selecting features and creating shapefiles; and finding data that meet spatial criteria.
http://ictupdate.cta.int/index.php/link/a/159/

The CPC, a multimedia knowledge base to identify pests

Amadou Bocar Bal and Julia Brunt

Accessible, cheap ICTs are providing increasingly effective ways to identify pests – the first crucial step in pest management. In several countries in Africa, a multimedia tool called the Crop Protection Compendium (CPC) is helping farmers, agricultural officers and scientists to recognize and control crop diseases and pests.

The CPC is a global compilation of crop protection knowledge for practical decision-making, edited by CAB International and supported by an international development consortium of more than 50 organisations in the public and private sectors. The compendium, which is updated annually, is used worldwide by crop protection specialists, extension workers, quarantine officers, plant breeders and policy makers, as well as farmers.

In Africa, a multimedia tool called the Crop Protection Compendium is helping farmers to recognize and control pests.

For instance, farmers who want to identify a particular beetle can visit their local telecentre and consult the CPC's vast encyclopedia on plant health and integrated pest management either via the Internet or on CD-ROM. They then select the key, or directory, on beetles, which presents a series of features (size, colour, etc.) from which they select those that apply to that particular beetle. Its clear navigation tools, illustrations and text make it easy to identify the pest quickly and accurately, and obtain information on appropriate management strategies.

Theophilus Mlaki of Tanzania's Commission for Science and Technology is promoting the CPC to assist rural farmers. 'We aim to empower local officials to be the brains behind the community's agricultural information', he says. 'The CPC is user-friendly and accessible to the officials who travel to villages to help farmers identify pests. Part of the compendium's success lies in its wealth of illustrations. We can produce printouts of a pest or disease and give them to farmers, together with information in local languages.'

In Niger, the CPC is also being used at the AGRHYMET Regional Centre as a tool for identifying agricultural pests and as a source of information on their biology, ecology and suitable control methods. Established in 1974 by the Permanent Interstate Committee for Drought Control in the Sahel, AGRHYMET provides training and information on food production and natural resource management. The CPC has become an important teaching tool at AGRHYMET, particularly for students enrolled in its crop protection programme. Students are particularly impressed by the illustrations, which make the keys easy to use. The centre received a copy of the CPC as part of a USAID project in which 250 copies were distributed throughout Africa.

CABI is continually updating the technology supporting the CPC in order to exploit the opportunities offered by rapid developments in ICTs. One innovative feature of the CPC is its dynamic 'softlinks', which are not 'hard wired' like hyperlinks. When a user enters a query in the CPC, the user is not taken to one fixed location but is instantly 'softlinked' to a wide range of related information, such as on other countries or pests, glossary entries, bibliographic records or other databases.

New delivery media, such as digital video disks (DVDs) and personal digital assistants (PDAs), are also being explored. In view of the technology constraints faced by many users in ACP countries, however, the compendium will continue to be available on CD-ROM for the foreseeable future.

The development of the CPC will continue to respond to user demand, with the support of the consortium. For example, projects are under way to improve the information on invasive species, and on forest pests and diseases. CABI is also investigating ways to promote the use of the compendium in developing countries, such as through training programmes, and is exploring the feasibility of developing versions of the CPC tailored to specific local needs and in local languages.

For more information on the CPC, and to register for a 30-day free trial, visit *www.cabi.org/compendia/cpc/index.htm*, or contact *compend@cabi.org*.

Amadou Bocar Bal is a trainer at AGRHYMET in Niger (email: *bal@sahel.agrhymet.ne*).

Julia Brunt is the Compendium Programme Manager at CAB International (email: *j.brunt@cabi.org*).

Relevant links

Diagnosis is a multimedia software package to support the process of diagnosing crop problems, such as pests and diseases. The user is presented with a problem scenario and must interrogate the programme to diagnose the situation. In other words, Diagnosis is an interactive 'adventure game' for plant pathology. Users can download one of more than 20 diagnostic scenarios, or get a free demo. *www.diagnosis.co.nz/*

FloraMap is a free software tool available on CD-ROM that links to various databases and draws detailed maps of the most likely distribution of plants and other organisms in the wild. The product of more than 20 years of research at the **Center for Tropical Agriculture (CIAT)**, FloraMap shows the topographical and climatic conditions that favour pest outbreaks, and enables IPM specialists to predict future hot spots. w*ww.floramap-ciat.org/*

Using ICTs to eradicate the Carambola fruit fly

Shantanu Mathur

The successful development of environmentally benign technologies for the control and eradication of pests often requires strong information and communication support, involving concerted action among various international stakeholders. ICTs are becoming indispensable tools in classical biological control as well as in integrated pest management (IPM) strategies aimed at bringing pest infestations down to manageable thresholds, or at total eradication. They have proven invaluable in the speedy diagnosis and confirmation of pests, in planning and designing effective responses, in the deployment of the most suitable eradication technology, and in post-campaign quarantine operations.

ICTs are becoming indispensable tools in efforts to bring pest infestations down to manageable thresholds or to eradicate them completely.

The Carambola fruit fly project, led by the International Fund for Agricultural Development (IFAD), has successfully employed both state-of-the-art communication technologies as well as traditional information exchange to eradicate this pest, which affects the livelihoods of smallholder fruit farmers throughout Suriname and French Guiana.

In the mid-1990s, the presence of the Carambola fruit fly (CFF) represented a major threat to the production and marketing of fruits and vegetables throughout tropical and subtropical Central and South America and the Caribbean. Entomologists identified 236 different species of host fruit, and surveys found that the initial spread of the CFF was linked with increased fruit cultivation and the transportation and marketing of infected material. It was also discovered that the CFF is highly mobile, and can migrate distances of more than 50 km.

Various ICTs were employed to determine the range of the pest, but the simple fax machine proved to be the most effective means of distributing information, such as survey data, bulletins, aerial photographs and maps. It was found that the fly is not constrained by natural barriers such as dense forests, or by the isolated pockets of fruit tree cultivation. In view of the steady increase in the volume of unofficial trade in fruit across countries in the region, the situation demanded an immediate response.

Central to the pest control strategy has been the male annihilation technique (MAT), which involves the use of a powerful male attractant mixed with a bioinsecticide. As male flies are attracted to the lure and are killed by the insecticide, the male population is reduced to the point where reproduction is no longer possible, eventually leading to eradication. Fibre blocks impregnated with the mixture are dispersed from ultralight aircraft equipped with a simple geographical information system (GIS)/global positioning system (GPS) unit to ensure comprehensive coverage of the infested area, which straddles several countries.

The ICT-based approach – using technologies ranging from written materials to multimedia and remote sensing – has undoubtedly contributed to the efficiency and effectiveness of the eradication programme. ICTs were also used to support a public relations campaign and an extension programme to ensure that rural communities understand and participate in the programme. Radio, TV and group video sessions were used to build the local institutional capacity, including training, environmental monitoring, and research to provide information for the development of techniques for fruit fly detection, control and eradication.

The lynchpin of the CFF campaign has been the establishment of an efficient regional organizational framework for a concerted effort to detect, monitor and eradicate the CFF. An ICT platform using modern electronic information exchange, combined with conventional knowledge networks, have been indispensable in ensuring the coordination of inputs of scientists, technicians and administrators. Although the project has been remarkably successful in reducing pest populations to zero in most infested areas, future funding is uncertain. It would be unfortunate if the effort is abandoned before the Carambola fruit fly is fully eradicated from the few remaining hot spots.

For further information on IFAD's biocontrol programmes, visit *www.ifad.org/events/past/anniv/bio.htm*.

Shantanu Mathur is coordinator of research grants at IFAD (email: *s.mathur@ifad.org*).

Relevant links

GeoWeb is a web-based application that allows users to see satellite-based data and imagery used by FAO's **Global Information and Early Warning System (GIEWS)** analysts. Users can put together customized maps to assess the crop and food supply situation in their part of the world.
http://geoweb.fao.org/ and *www.fao.org/giews/english/giewse.htm*

The FAO's **Emergency Prevention System (EMPRES) for Transboundary Animal and Plant Pests and Diseases** is part of the **GIEWS** initiative and helps to minimize the risk of pest emergencies developing by offering forecasts and warnings as well as coordinating the management of pest outbreaks.
www.fao.org/EMPRES/default.htm

Projects and initiatives

This section lists key projects and initiatives in the field of integrated pest management (IPM) and ICTs. Additional information, including a comprehensive overview of online IPM databases and knowledge dissemination networks, is available from the web magazine at *http://ictupdate.cta.int*.

AFRICA

The FAO's **Africover project** is addressing the lack of qualitative and quantitative information on vegetation cover and land use change by compiling digital maps for the whole of Africa, using remote sensing data and GIS technology. The project aims to enhance the long-term capability of African institutions to produce and utilize reliable information to predict crop yields and pest habitat distribution. *www.africover.org/*

The **AGRHYMET Centre** in Niger uses remote sensing data and maps to address natural resource management and food security issues, and in particular pest outbreaks, for the nine West Africa member states of the Permanent Interstate Committee to Combat Drought in the Sahel (CILSS). It maintains a database on pest occurrences as well as a meteorological database that can be used to estimate current and future pest distributions. *www.agrhymet.ne*

The **East and Southern Africa Regional Vegetable IPM Project** of the Southern African Botanical Diversity Network (SABONET) aims to encourage IPM in horticultural production and to enhance online interaction and information exchange among researchers in eastern and southern Africa. The project supports research directed at the economically important pests affecting brassicas, citrus, French beans and tomatoes. *www.sabonet.org/reddatalist/database.html*

The **Pesticide Action Network (PAN) Africa** runs the online Africa Resource Centre on Chemical Pesticides, IPM and Sustainable Agriculture in Senegal, which is the premier source of public pesticide information in Africa. The Centre promotes the electronic exchange of documentation in French, English and Spanish, including catalogues, periodicals, reports and studies dealing with pesticides, IPM and natural crop protection.
www.pan-africa.sn/english/documentationeng.htm

The **Famine Early Warning Systems Network (FEWS NET)** is a USAID-led initiative that uses satellite imagery to provide estimates of the amount and vigour of vegetation across Africa, and aims to empower the 17 participating countries to find solutions to food insecurity problems, often caused by pests. The initiative is supported by AGRHYMET in Niger, the Drought Monitoring Centre in Kenya, and the SADC Regional Early Warning Unit in Zimbabwe, which provide imagery, analyses and reports on vegetation conditions. *www.fews.net/*

The **Information Core for Southern African Migrant Pests (ICOSAMP)** is an information system for decision makers in southern Africa. The project addresses the need for a forum where all data relevant to migrant pests in the region can be collated and distributed. It contributes to cross-border communication and cooperation by utilizing an Internet-based information system that includes databases of regional and national pest control organizations. It also promotes an automated input and retrieval system of migrant pest information hosting GIS-based spatial distribution maps.
http://icosamp.ecoport.org/

CARIBBEAN

The **Caribbean Integrated Pest Management Network (CIPMNET**) of PROCICARIBE, the Caribbean Agricultural Science and Technology Networking System, promotes collaboration among member states with linkages to international organizations in delivering more effective IPM in the region. The network aims to improve IPM technologies adopted by technicians, researchers, and farmers, and disseminates IPM information through its database, website and various information products. *www.procicaribe.org/networks/cipmnet/index.htm*

The **Caribbean Animal and Plant Health Information Network (CARAPHIN)** of the Caribbean Regional Centre of the Inter-American Institute for Cooperation on Agriculture (IICA) disseminates online technical information on agricultural and environmental health, particularly information that is generated in and for the Caribbean region. The network focuses on plant diseases and insect pest outbreaks. *http://infoagro.net/health/caraphin/*

CARINET is the taxonomic capacity building network of the Caribbean for those involved in the biosystematics of arthropods, nematodes, micro-organisms, non-vascular and vascular plants. Users can search the CARINET databases for species (entities), experts, plant health laboratories and other institutions.
http://carinet.ecoport.org/

ASIA & THE PACIFIC

The **Asia-Pacific Regional Technology Centre (APRTC)** is a non-profit organization dedicated to improving the welfare and knowledge of farmers and the promotion of sustainable agricultural practices. The Centre's e-learning programme **'agLe@rn'** offers courses for agricultural professionals focusing on sustainable agriculture, including IPM for cotton, irrigated rice and vegetables, and promotes responsible pesticide use. *www.aprtc.org/*

The **Secretariat of the Pacific Community (SPC) Plant Protection Service (PPS)** collaborates with countries and territories in the region to reduce the impact of pests, diseases and weeds in agriculture, forestry and the environment, focusing on prevention, preparedness and pest management. Its **Pest List Database (PLD)** is a regional information system for recording and disseminating reports on pest occurrences within Pacific states.
www.spc.org.nc/pps/

The **Pacific Islands Ecosystems at Risk (PIER)** project compiles and disseminates information on exotic plant species of known or potential threat to Pacific Island ecosystems. In consultation and coordination with other Pacific Rim and island nations, as well as with international agencies, the project provides information for quarantine officers, land managers, and others interested in protecting forest and wild ecosystems. The project publishes (on the website and CD-ROM) descriptions of plant species that threaten natural and semi-natural island ecosytems, plus a toolkit of best prevention and management practices. *www.hear.org/pier/*

The **Pacific Fruit Fly Web** is a pest management project run by the Secretariat of the Pacific Community (SPC). The site includes fruit fly outbreak alerts for the region, profiles of fruit fly species, control and quarantine methods, and success stories. *www.pacifly.org/*

The **Tata Kisan Kendra project**, launched by the Tata Group, a private sector IT company, is helping small farmers in India harness the benefits of sophisticated technologies such as satellite mapping and GIS to enhance the yield from their land and combat pests. At a local Tata Kisan Kendra (TKK), or farm centre, farmers can download images of their fields and advice on what type of crop to grow, where and when to grow it, and how much fertilizer to use. The TKK tracks key parameters relevant to farming practices, such as soil, groundwater and weather on a real-time basis with the help of GIS. This information also helps farmers to predict pest attacks.
www.tatatkk.com/index.htm

Q&A: The status of ICTs in integrated pest management

Yunlong Xia

In a recent interview, **Dr. Yunlong Xia** (email: *yxia@icipe.org*), Head of the Information Technology and Bioinformatics Department at the International Centre of Insect Physiology and Ecology (ICIPE) in Kenya, provided an overview of the status of and trends in the use of ICTs in the field of IPM in developing countries.

In what ways are ICTs helping to control pests?
As a systems approach to pest control, IPM has benefited significantly from a wide range of ICT applications. In a recent review, Andrew Bartlett, Senior IPM Programme Development Officer at the FAO [1], categorized the various fields of IPM in which ICTs are being applied. These fields can be grouped as follows: IPM policy making and extension services; pest identification; IPM information dissemination and sharing; Internet-based decision support tools; and ICT-supported training.

Can you describe these fields?
By facilitating international communications and the sharing of resources and information, Internet-based networks have enhanced both the development of IPM policies and the effectiveness of IPM extension services. Initiatives such as the Africa IPM Forum at ICIPE [2], the Global IPM Facility at FAO [3], the CGIAR's System-wide IPM Programme [4] and many other online resources [5] have helped decision makers and regional agricultural officers become more aware of the benefits of IPM approaches, and have contributed to the adoption and successful implementation of IPM policies in many developing countries. What's more, these networks have enabled many extension services to improve their outreach, and with the assistance of ICTs in farm field schools and telecentres, many farmers in developing countries are now practising IPM techniques.

ICT applications such as CD-ROMs and web-based tools for pest identification have been developed for a wide range of users, from farmers to students and researchers. Examples include the FAO's EcoPort initiative [6], CABI's Crop Protection Compendium and PEST CABWeb [7], Cornell University's Global Crop Pest Identification and Information Services [8], and the pest identification software and CD-ROMs produced by the Centre of Biological Information Technology [9].

Information dissemination and sharing have contributed to the implementation of IPM solutions for a wide range of pest problems. For example, initiatives such as IPMNet [10], Africa IPM Link [11] and IPM CRSP [12] have developed a variety of effective ICT channels for disseminating information, such as websites, online databases and discussion forums, email list servers and multimedia CD-ROMs. In particular, the IPM Communications Workshop for Eastern/Southern Africa (ICWESA) in 1998 led to the establishment of regional online IPM collaborative networks for information sharing, including the Africa IPM Forum and Africa IPM Link listserver [13].

Internet-based decision support systems provide users with all the information they need to select the most appropriate pest control strategy, including means of pest identification, pest life cycles, sampling and decision-making criteria, sampling threshold calculations, and pest distribution models linked to weather monitoring systems. They also offer details of environmentally friendly biocontrol methods, as well as of available pesticides and their safety risks and environmental impacts. These applications could be further improved with the addition of 'intelligent' functions such as e-learning tools and dynamic simulations of crop ecosystems [14].

IPM training materials for many crop systems are available on CD-ROM or online [11, 15]. ICTs have also provided convenient ways to offer training via virtual campuses or distance learning courses [16] tailored to the needs of the scientific community or farmers and extensionists. Many of the training materials can be used as reference materials by users in ACP countries, or have even been specifically developed for individual developing countries.

What are some of the trends in IPM?
With the growing range of mobile ICT applications, such as web-capable mobile phones, handheld computers and global positioning systems (GPS), IPM practitioners will be able to access relevant information anywhere, at any time. This may inspire insect informatics experts to create IPM information and products that are relevant for specific locations at particular times. As a result, I believe that in the future more web-based intelligent information systems will be developed that will allow users to access real-time online information that is relevant to their needs, rather than the technology-driven products that are currently available.

Links

[1] *http://ictupdate.cta.int/index.php/link/a/158/*
[2] *http://informatics.icipe.org/ipmafrica/*
[3] *www.fao.org/globalipmfacility/*
[4] *www.cgiar.org/spipm/*
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[6] *www.ecoport.org*
[7] *http://pest.cabweb.org/*
[8] *www.nysaes.cornell.edu/ent/hortcrops/*
[9] *www.cbit.uq.edu.au/*
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[13] *http://informatics.icipe.org/icwesa/*
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[15] *http://ipmworld.umn.edu/chapters/macrae.htm*
[16] *www.ent.iastate.edu/list/online_courses.html*

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